



# **Examples of White Collar Measurement Using A Typology of Organizational Effectiveness**

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## Foreword

This report describes the four major components of organizational effectiveness (Productivity, Financial Performance, Stakeholder Relations, and Resource Development) and provides examples of measures that may be useful for organizations that are contemplating the implementation of a Productivity Gain Sharing (PGS) system.

The success of PGS requires measures that accurately reflect improvements in productivity and other components of an organization's performance. Thus, organizations need to have a valid and reliable performance measurement system. This report demonstrates how effective performance indicators can be developed.

This report is one of a series of reports on measurement issues related to PGS and total quality. The other reports in this series are: (1) *Using Performance Indexing to Measure Organizational Gains in a White Collar Environment* (Tatum, Nebeker, & De Young, 1996); (2) *An Approach to Measurement of Quality and Productivity for Gain Sharing: Measuring Total Organizational Value* (Nebeker & Tatum, 1996); and (3) *Integrating Measurement Approaches in Gain Sharing and Total Quality* (Tatum, Shaw, & Main, 1996).

This report also has a companion report that discusses many of the components of organizational effectiveness in greater detail. The companion report is *A Typology of Organizational Effectiveness* (Tatum, Nebeker, & Wolosin, 1996).

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## **Summary**

### **Problem and Background**

The Federal Government has recognized the need for increased organizational effectiveness within its agencies. Organizational effectiveness will become more of a necessity in the future with the implementation of the Government Performance and Results Act of 1993. However, it has been a problem, especially for white collar organizations, to measure performance accurately. This poses a particular problem for those organizations that are contemplating the implementation of a Productivity Gain Sharing (PGS) system. The success of PGS requires an accurate reflection of organizational performance.

### **Objective**

The purpose of this report is to demonstrate how effective performance indicators can be developed to establish a valid and reliable measurement system. It is to be used as a primer on the theory and practice of performance measurement for all organizations, but especially for white collar organizations interested in developing measures of organizational effectiveness.

### **Approach**

The report first discusses basic measurement issues. Second, it breaks down organizational effectiveness into four major components (Productivity, Financial Performance, Stakeholder Relations, and Resource Development). Each component is then discussed and examples of measures are provided that may be useful for the purpose of PGS.

### **Conclusions**

Organizations interested in increasing their effectiveness need to establish valid and reliable performance measurement systems. This is especially true for those organizations that would like to implement PGS, because the success of PGS rests on the quality of the measurement system.

When developing a measurement system, emphasis should be placed on total organizational improvement and not just limited to improvement in one area. Effective PGS systems should incorporate some measures from all four components so that total organizational performance can be monitored and improved.

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## Introduction

This document represents a primer on the theory and practice of performance measurement. As the title suggests, the principle audience is the government organization, but almost any organization (service, manufacturing, technical, government, etc.) can benefit from the general measurement principles outlined in this paper. Although this report will be useful for any organization concerned with accurate and reliable performance measurement, the information here will be especially useful for organizations contemplating the implementation of productivity gain sharing (PGS). The success of PGS depends largely on the precision and validity of the measurement system, and this document provides guidance on how to develop measures of performance. For government organizations, even if PGS is of no interest, accurate measurement is going to become more of a necessity in the future with the implementation of the Government Performance and Results Act of 1993.

Developing a measurement system involves several steps as outlined by Tuttle and Sink (1984). Two critical steps involve defining key result areas and developing performance measures (see Tatum and Nebeker, 1996, for a description of these and other measurement steps using software development as an illustration). An organization's key result areas are absolutely essential to meeting its mission objectives and strategic goals (see Tuttle, Wilkinson, & Mathews, 1985, for excellent examples of the process used to generate key result areas). Performance indicators measure these key result areas. Organizations interested in PGS can use this document to (1) help define key result areas; (2) identify performance indicators for PGS; (3) begin measuring the indicators and tracking them over time; (4) revise, eliminate, or add new indicators; (5) decide on the optimal set of indicators for PGS; and (6) make future adjustments to the indicators.

PGS focuses on improving the total performance of the organization. Measures of total organizational performance (organizational effectiveness) fall into four broad areas, productivity, financial performance, stakeholder relations, and resource development, as shown in the typology presented in Table 1.<sup>1</sup> Each of these areas can be further subdivided into more narrowly focused areas (also shown in Table 1). This document will discuss each of these areas briefly (for a more detailed treatment see Tatum, Nebeker, & Wolosin, 1996) and then make recommendations for developing specific measures that reflect improvements in these areas (some sample measures are also shown in Table 1). Not all organizations will be interested in all of the measures discussed. Certain areas and measures will be relevant to some organizations, while other areas and measures will be more germane to other organizations. Probably some measures are desirable from each of the four broad areas, but for the purposes of PGS most of the measures will come from the first two areas (productivity and financial performance). The underlying purpose of this document is to get organizations to think about what the most appropriate set of measures should be for them, and then develop that set to track improvement and establish a measurement system for PGS. Although the measures described here focus on the needs of white collar organizations, many of the measures will apply to any type of organization.

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<sup>1</sup>Table 1 is a typology rather than a taxonomy. Taxonomies are empirically derived, hierarchical systems whereas typologies are classifications based on theoretical and intuitive categories (see Rich, 1993, for more details on the distinction between taxonomies and typologies).



Table 1

## Examples of Measures Using the Organizational Effectiveness Typology

Organizational Effectiveness			
Productivity	Financial Performance	Stakeholder Relations	Resource Development
<b>Process Quality (Efficiency)</b>	<b>Budgeting</b>	<b>Employee Quality of Work Life</b>	<b>Employee Development</b>
<i>Input Quantity</i>	<i>Revenue</i>	1. Organizational Climate Survey	<i>Recruitment</i>
1. Total labor hours worked	1. Total revenue	2. Data from the dispensary	1. Data from personnel office
2. Capital assets	<i>Costs</i>	3. Absenteeism & turnover	2. Data from Bureau of Labor Statistics & Census
3. Standard units of material used	1. Dollars spent on total labor	4. Exit interviews	3. Data from local information sources
4. Units of energy consumed	2. Depreciation of capital assets	<b>Customer Relations</b>	<i>Selection</i>
<i>Output Quantity</i>	3. Dollars spent on materials	1. Internal Customer Survey	1. Data from personnel office
1. Raw units of goods	4. Dollars spent on energy consumed	2. Organizational Reputation Surveys	2. Survey of budget analysts
2. Raw units of services	<b>Marketing</b>	3. Focus group interviews	<i>Training</i>
3. Sales Value	1. Market share	4. Unsolicited letters	1. Acquisition measures
4. Physical measurement		<b>Public Relations</b>	2. Job performance measures
5. Work content		1. Public Opinion Surveys	3. Standardized tests
<i>Process Improvement</i>		2. Unsolicited letters of approval or disapproval	<b>Technology Development</b>
1. Data from control charts		<b>Government Relations</b>	<i>Work Methods</i>
2. Benchmarking		1. Inspection team reports	1. Time since last process analysis
3. Time on inspection		2. Complaints regarding regulatory violations	2. Benchmarking
4. Time on rework		3. Meeting codes/regulations	3. Use of latest technology
5. Amount of scrap & waste			<i>Physical Resources</i>
<b>Output Quality</b>			1. Age of physical resources
<i>End-Product Inspection</i>			2. Condition of physical resources
1. Proportion of output units passing inspection			
<i>Product/Service Attributes</i>			
1. Customer surveys			
2. Statistical process control (SPC) tools			
3. Structured interviews			
4. Customer complaints			
5. Unsolicited letters of appreciation			
6. Returns			
7. Comment cards			
<i>Timeliness</i>			
1. Just-In-Time Index			
2. Shelf life			
3. Conformance to schedule			

## Basic Measurement Issues

Before discussing specific measures, some basic issues related to measurement will be introduced.

### Criteria for Good Measures

If an organization wants to select the best set of performance measures, several criteria should be met. Many of the desirable characteristics can be described with the acronym ACORN.

*A = Accomplishment*—the measures should reflect the accomplishments of the organization and not just behaviors that may or may not be of value to the organization.

*C = Control*—the measures should be under the control of members of the organization.

*O = Overall*—the measures should reflect important elements of the organization as a whole. They should cover all critical aspects of organizational performance.

*R = Reconciled*—the measures should be reconciled with the objectives of all organizational elements. The entire set of measures should be consistent with the optimal performance of the whole organization. In other words, individual measures that reflect a part of the system should not be emphasized at the expense of the whole.

*N = Numeric*—the measures should reflect a numerical value that can be monitored across time.

In addition to having the above characteristics, measures should also have the following properties if they are to be truly useful for the organization.

### Validity

Validity refers to whether a measure accurately reflects the characteristic it is intended to capture. Validity is the most important property of a measure. Mean-time-between-failures of a part, or how closely a product meets its specifications, are examples of valid measures of performance because, usually, they accurately reflect aspects of quality. But how do you measure the quality of some product or service that is not so easily quantified, such as an audit, or a training program, or a research project? In such cases, more subjective measures must be developed and used. However, this is not necessarily bad, because subjective measures are often perfectly valid indicators of the characteristic being measured. For example, customer satisfaction ratings of a service are usually the best indicator of the quality of a service. Indeed, subjective data such as satisfaction ratings, if collected properly, can have greater validity than more objective data (e.g., sales have been shown to be a poor indicator of a product's quality).

### Reliability

Reliability refers to the consistency of a measure. A useful measure remains stable across time. Even hard data (e.g., items shipped, engines repaired) may not have this property. If the attribute being measured is inherently stable, but the measurement of that attribute fluctuates greatly (e.g.,

due to inadequate data recording procedures), then the information may be too inconsistent for the organization to use, no matter how objective it is. If measures are not reliable, then efforts must be taken to make them more stable (e.g., calibrate data recording instruments, collect the data for longer time periods, aggregate several sources of data into a single measure).

### **Standardization**

Standardization refers to collecting measurement data in a consistent, uniform fashion. Standardization helps to achieve greater reliability and insures that errors are not introduced into the measurement system.

### **Sources of Measurement**

An organization's performance can be derived from several sources.

#### **Objective Sources**

Most organizations have systems that generate quantifiable performance data. For example, if an organization makes machine parts, or repairs engines, or delivers supplies, it probably has systems in place (e.g., automated tracking, manual record keeping) that monitor both the processes and outputs. The measurements that are routinely taken from these systems can be used as measures of organizational performance.

#### **Subjective Sources**

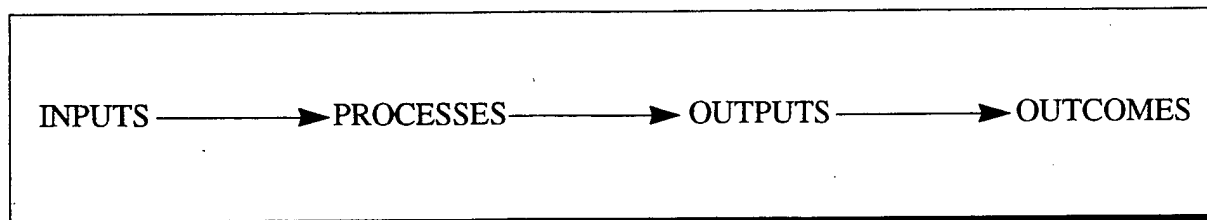
Some types of information cannot be obtained by objective means. For example, a customer's level of satisfaction with a product, or the quality of work performed by a research team, are inherently a subjective judgments. Many important elements of an effective organization can be assessed only by pooling expert judgments or surveying public opinion. These subjective measures are not necessarily less desirable measures than the objective measures discussed above. If measures are valid, reliable, and standardized, it really does not matter if they come from objective or subjective sources. In fact, if the procedures for obtaining subjective judgments are standardized, these judgments may be considered objective to those collecting the information. An employee survey, for example, if conducted properly, can tell an organization a great deal about its climate or culture despite the fact that the source of the data are subjective opinions or perceptions.

#### **Archival Sources**

Most organizations maintain archival records of many aspects of their operations. Records of sick leave use, absenteeism employee, turnover, or accident rates are usually recorded by organizations. These archival data can often be used as indices of organizational performance. For example, if an organization suspects that productivity suffers because of high absenteeism, then an examination of the archival records can verify this suspicion. Collecting archival data on absenteeism, or turnover, or accident rates can be useful in determining whether the organization is improving its performance.

## **Types of Performance Measures**

The Department of Defense (DOD) Comptroller has issued guidance on measuring organizational performance and has outlined a useful classification of performance measures (Memorandum from Acting DOD Comptroller, 1992). According to the DOD Comptroller, performance measures are indicators of an organization's effectiveness and efficiency that are directly tied to results. Performance measures document the relationships between resources (inputs) and results (outcomes) as illustrated in the following diagram:



According to the DOD Comptroller, performance measures fall into four categories: efficiency, effectiveness, outcome, and process.

### **Efficiency Measures**

Efficiency measures demonstrate how well an organization is using its resources. They are typically expressed as an input/output ratio. For example, unit cost, labor productivity, and cycle time are all classified as efficiency measures because they relate some input (cost, labor hours, time) to some output (e.g., items shipped, parts repaired, students trained). Efficiency is often referred to as “doing things right” because it tells an organization to what degree it is using its resources wisely.

### **Effectiveness Measures**

Effectiveness measures mean “doing the right thing.” They indicate whether an organization is meeting its output goals. These goals can be specified along a quantitative, qualitative, or timeliness dimension. For example, if a goal is to repair a certain number of engines in a given month, a quantitative index of effectiveness would reflect whatever that goal was met or exceeded. Another measure of effectiveness might indicate that a product or service exceeded objective criteria for quality, or that an organization met scheduled completion dates. In all of these examples, effectiveness is judged by how well an organization meets its goals for quantity, quality, or timeliness. Measures of effectiveness do not have to be strictly objective measures such as meeting a production quota or deadline. Customer satisfaction, for example, is a subjective judgment made by the user of the product or service. Nevertheless, customer satisfaction ratings are clearly an important measure of the effectiveness of an organization.

### **Process Measures**

Process measures capture the way work gets done during the process of producing a good or delivering a service. Process measures indicate the degree of control over internal operations.

These measures can be used to diagnose problems and streamline work procedures. For example, processing a delivery order in a government contract office requires several steps (e.g., write statement of work, develop cost estimate, obtain technical review, make request for quote, negotiate with contractor). Each of these steps or processes, in turn, can be broken down into subprocesses, and the subprocess can be broken down into sub-subprocess, ad infinitum. Any or all of these processes and subprocesses can be measured and these measures can be used to improve efficiency. For example, if the contracting office measures the time required to complete each step, these times can be used to diagnose where the bottlenecks are in the system (e.g., writing a statement of work takes longer than the other process). If changes are made to streamline part of the process, the process measures can help verify whether these changes had a positive effect (i.e., training on how to write a statement of work reduced the time by 50%). The variability in process measures can also be indicative of improvements. For example, training people to write a statement of work may reduce the variation in writing times from contract to contract which is a reflection of a more stable, more consistent process. Process measures help us improve products and services by making the production or delivery process more efficient. However, process measures do not measure the attributes of the products and services directly. Process measures are critical if an organization is striving for continuous performance improvement.

### **Outcome Measures**

Outcome measures reflect progress toward strategic goals or mission objectives. For example, if the organization has a strategic plan that specifies certain strategic goals (e.g., health status of its employees, material readiness), outcome measures can be used to determine whether these goals are being met. As another example, if the organization's mission is to conduct research and development on weapons systems, outcome measures would indicate how well they were performing their mission.

### **Results-Oriented Versus Process-Oriented Measures**

A simpler way to classify measures is to use two broad categories that overlap with the DOD Comptroller's classification described above. The first category represents measures that are very general in nature and tend to be results-oriented. This category overlaps with the Comptroller's efficiency, effectiveness, and outcome measures. Examples of such measures include total hours worked, total revenue generated, units of energy consumed, cost associated with waste, or average customer satisfaction rating. These measures provide a general, overall picture of how the organization is performing in terms of the results it is trying to achieve.

The second category represents measures that are more specific in nature and tend to be process-oriented. This category overlaps with the Comptroller's process measures. The measures from this second category are very specific indicators of the internal processes of the organization. Examples of this second category include data from control charts, measures of scrap or waste, estimates of process capability, and so forth. The first category of measures is useful for getting a global view of an organization's performance. The second category of measures, by contrast, provides a more detailed view of the organization and helps diagnose internal problems that ultimately affect the final results.

Both results-oriented and process-oriented measures are important to PGS. Because PGS is concerned with improving total organizational performance, an organization needs to measure both its internal processes and its final outputs and outcomes. However, a word of caution, payouts from a PGS plan should only be based on improvements in results. Processes should be measured, and efforts should be made to continuously improve processes, but payouts should only be made on improvements in results. This statement is true for two reasons. First, an organization can improve processes without necessarily improving the output or outcome. For example, an organization could change its training programs so that the skill level of its employees is improved, but if the training were in areas that did not contribute to improved productivity (e.g., seminars on how to prepare for retirement), it would not make sense to tie these improvements to a productivity gain. Second, linking payouts directly to process improvements would constitute a form of double counting. Improvements in many processes ultimately show up as improvements in the final output or outcome. If some portion of the payout is based on process improvements, and some other portion is based on improvements in the end product that resulted from the process, the organization is essentially paying twice for the same improvement.

## **How to Use This Document**

As noted earlier, Table 1 shows the major components of organizational effectiveness. Table 1 provides examples of measures that may be useful in PGS. Within each of the four broad areas shown in Table 1 (productivity, financial performance, stakeholder relations, and resource development). The measures provided cover the full range of measures discussed earlier (i.e., input, process, output, outcome). When and how these measures should be used will be addressed next. However, remember that different organizations have different measurement requirements. Because of this heterogeneity, the measures discussed are general in nature, but specific enough to give most organizations a good idea of how to generate their own set of measures.

Measurement requirements are determined by the specific key result areas defined by the organization. In general, all organizations will have key result areas that reflect the quantity, quality, and timeliness of their products and services, but their importance will vary across organizations. For example, a supply center may emphasize timeliness of deliveries, while a data processing center stresses accuracy of completed jobs. Both organizations have timeliness and accuracy as key result areas, but the emphasis and weightings differ. Each organization will select and develop some performance measures unique to their requirements and areas of emphasis, but selection and development of measures will likely overlap (e.g., both will want indicators of customer satisfaction, both will probably want to measure the volume of their work). Therefore, how any given organization uses this document will depend on the unique character of the organization and the distinctive needs of that organization.

We recommend using this document as a guide to selecting and developing a set of measures best suited to that organization. The organization probably will want some measures from each of the four major areas in Table 1, but from the standpoint of PGS many of the measures will come from the first two areas (productivity and financial performance). We give many examples of measures for white collar organizations in this document, and many of these can be adopted by almost any organization without much modification. However, because every organization is unique, each organization must develop performance measures that reflect its distinctive

that our earlier discussion of measurement issues and the numerous examples to follow will clarify and simplify this task. The important thing to keep in mind when developing performance measures for a PGS system is "improvement." You want your measures to show whether you have made improvements in your key result areas. You want measures with numbers that tell you whether you have done better or worse.

## **Productivity**

Productivity refers to a statistical measure that reflects how inputs to the organization (e.g., labor, capital, and equipment) are used to produce outputs (goods and services). The terminology in the area of productivity is confusing and not always used consistently. Terms such as efficiency, performance, effectiveness, and quality are sometimes used interchangeably with productivity (see Tatum, Shaw, & Main, 1996, for a more complete discussion of definitions of, and relationships between, various terms). Here, productivity is expressed as a ratio of inputs to quality outputs (see Tatum, Shaw, & Main, 1996), and measures of productivity fall into two general areas: process quality (i.e., efficiency) and output quality.

### **Process Quality (Efficiency)**

The traditional view of an organization is vertical in that each department or business unit functions on its own with its own management hierarchy (Rumor & Brace, 1991). A more useful approach is a horizontal, or "systems," view that cuts across functional boundaries and is organized around processes that include inputs to the system, the transformation of these inputs into an output (product or service), and the delivery of the output to a customer. To achieve the greatest efficiency in transforming the inputs into the outputs, the organization must be able to measure quantities of inputs and outputs, and must be able to measure improvement efforts in the process of transforming the inputs into outputs. Efficiency is usually expressed as an input/output ratio. What follows are some alternative ways of measuring the quantities of the inputs and the outputs that go into this ratio.

### **Input Quantity**

Inputs are the resources used in the production of outputs. The four resources most commonly considered as important are: (1) labor (direct and indirect), (2) capital (equipment and facilities), (3) materials (raw material, purchased parts, and supplies), and (4) energy (fuel and power). These resources are also described by Nebeker, Neuberger, and Hulton (1983). Most of the following examples of measures of input quantity are expressed in nonfinancial terms (the financial equivalents are shown in the section on financial performance). These measures could, in principle, be expressed as dollar values, but only if the organization can be sure that these are constant dollars. If the dollars values do not remain stable (e.g., the cost of labor and materials fluctuates), then it is not a good idea to express these inputs as dollar values. Instead we recommend the nonfinancial quantities listed here.

*1. Total Labor Hours Worked:* A measure of the number of labor hours (both direct and indirect) used to produce the products and services. For example, in a data processing operation, this would be the total labor hours used for conducting training, writing software, running the

computers, and all support functions (e.g., secretarial services, purchasing, travel). In a research and development lab, this would be a measure of the scientist and technicians used on research projects as well as the support personnel. You show improvement in this measure by reducing the labor hours used to produce the same quantity and quality of output as in the past (measures of output quantity and quality are discussed in a later section).

2. *Capital Assets:* The number of major capital investments made. This measure can be expressed as the cost or the depreciated value of equipment or facilities. In general, improvements in this measure are shown by increasing output for a given level of capital investments or decreasing capital costs without having a negative effect on the product or service and without jeopardizing long term survival. If it can be shown that investing in capital assets improves the product or service and enhances survival, then more, rather than less, investment is good.

3. *Standard Units of Material Used:* Items such as the number of units of material used, pounds of material used, or number of feet used. These same metrics can also be used to measure waste and scrap. An organization can show improvement by lowering the amount of material used to produce the same quantity and quality of output.

4. *Units of Energy Consumed:* The amount of energy used in the production process. Examples of this are Kilowatt hours and Therms. Information from these measures can be compared to past usage and also to the usage of other organizations. Improvements show up as lower units of energy consumed relative to past usage or relative to other similar organizations.

### **Output Quantity**

An organization's internal operation results in some output (a product or service). Output quantity refers to the number of units completed in some time period (Nebeker et al., 1983). Measuring output units has typically been a challenge for white collar organizations. Identifying and qualifying specific output units is often difficult. According to Ringham (1982), outputs can be categorized as product units (pieces, dozens, or cases), physical units (pounds, square feet, gallons, or bushels), sales/service units (orders, deliveries, or invoices), value (sales value or value added), and work content (standard labor hours, standard machine hours, or estimated labor and machine hours). Although these categories cover the outputs in a general sense, this classification is not too helpful when an organization (especially a white collar organization) is trying to be specific about identifying and quantifying its outputs. The best advice that can be given to any organization is to let customers define outputs. After customers have specified a specific product or service they need, then investigate ways to measure the quantity of this output. Guidelines provided by the Bureau of Labor Statistics (BLS) can be helpful in quantifying outputs. The BLS publishes an annual report from its Federal Productivity Measurement System (FPMS) that summarizes labor productivity trends for 28 broad government functions, including many DOD functions (see Bureau of Labor Statistics, 1993c; Bureau of Labor Statistics, 1993d). The BLS has several specific guidelines for the kind of output data reported by the agencies that are included in the FPMS (Forte, 1993; Bureau of Labor Statistics, 1993a). These guidelines include:

- Output measures should reflect the final products and services of an organization. Final products and services are outputs that are consumed by customers or agencies outside the boundaries of the organization. For example, a library purchases books and periodicals, catalogs



these materials, and then lends them to individuals and other institutions. The outputs are the books and periodicals lent. The purchasing and cataloging activities are intermediate tasks, and would not be counted as outputs.

- If sets of output measures are not homogeneous (i.e., they are not of equivalent complexity or they do not have the same labor requirements), then a weighting factor should be applied to the measures. For example, if a printing shop measures pages of documentation, they should distinguish between long run pages and short run pages by assigning different values to the measures.

- To the extent possible, output measures should reflect repetitive processes (e.g., periodic audits, frequent requests, regularly scheduled maintenance) rather than processes that occur infrequently or on a one-time basis. Repetitive processes can be checked for consistency and stability, whereas nonrepetitive processes are subject to unexpected variation and instability.

- Measures should reflect outputs that are related to the workloads of the organizations and not work performed by third parties or outsourcing agencies. If an organization contracts out its janitorial services, for example, it can measure the processing of the contract (work that the organization performs), but should not count the custodial work performed by the contractor as part of the organizations's outputs.

- If work is the joint effort of two or more organizations, the output measures should reflect the separate contributions of each organization. For example, if several regional offices contribute data to a headquarters command that then produces a report, the data supplied by a particular office would be the measure of output from that office. The final report can be counted as an output for the headquarters, provided that headquarters is a separate organizational entity from the regional offices. If the regional offices and headquarters are all part of the same organizational entity, then it would not be proper to count the data and the report as separate outputs. In this case, the data are intermediate steps and the final report is the output. Counting the intermediate steps and the final report as outputs is equivalent to double counting.

- For government organizations that work on a fiscal year basis, performance measures should be scaled for the fiscal year. For example, if it takes 5 years to build a ship, it would be improper to count one ship built in the fifth year and zero in each of the first 4 years. Instead, it would be better to measure the portion completed in each year, or to break the ship building process into major steps and measure the completion of steps in each year.

Because outputs vary tremendously across organizations, only some general examples of how to measure output quantity can be offered, based on Ringham's (1982) classification. (See the report by the Bureau of Labor Statistics, 1993b, for a more extensive list of possible output measures.) As with the input measures, most of the following examples of measures of output quantity are expressed in nonfinancial terms (the financial equivalents are shown in the section on financial performance). Again, these measures could, in principle, be expressed as dollar values, but only if the organization can be sure that these are constant dollars. If the dollars values do not remain stable (e.g., customers renegotiate lower prices), then it is not a good idea to express these outputs as dollar values and we recommend the following nonfinancial quantities listed here. The BLS also discourages using dollars as an output measure (Forte, 1993).

1. *Raw Units of Goods*: A count of the total number of goods produced. For example, an audit service can count the number of audit reports produced. A research and development center can count pages of documentation, or the number of patents granted. Of course, counting these outputs is far more complex than implied here (e.g., you may have to weight each output by its level of complexity, or you may have to take into consideration changes in the mix of work over time). Once the organization develops a standardized way of counting the outputs, improvement is then reflected in an increase in the number of raw units produced given a constant amount of input and no decline in quality (measures of quality are discussed in a later section).

2. *Raw Units of Services*: Similar to raw units of goods except this is a count of the total number of services delivered. As with raw goods, complexity may be an issue (some services may be more complex than others) and so a weighting scheme may be required. For example, a contracting office can count the number of completed contracts issued, but each contract is scaled in terms of complexity so that more credit (or weight) is given for some contracts (see Forte, 1993; Tatum & Nebeker, 1996 for examples of how to weight indicators). Another example might be a training center that counts the number of recruits trained. If all recruits get the same training then an unweighted count is appropriate. If different levels of training are delivered, then a weighting scheme reflecting the difficulty of the training should be employed. In both examples, if an increase in these quantities (contracts, recruits) is achieved without increasing the inputs or lowering the quality, improvement has occurred.

3. *Sales Value*: Although as a general rule it is not a good idea to use dollars as an output measure, there are cases in which the revenue generated from an operation can be a good indicator of output. For example, a commissary can calculate the deflated dollar value of the sale of food and other items. If the mix of items varies widely in terms of dollar value (e.g., million dollar tanks vs. much less expensive rifles), then sales value probably is not a good output measure, and an alternative should be found. However, assuming a homogeneously priced set of items, a continual increase in the revenue is an indication of improvement.

4. *Physical Measurement*: Assess the physical changes in a product such as weight or volume. For example, a supply center measures the volume changes or weight changes in its shipments. The ability to move a greater volume of shipments for a constant or lower resource use suggests improved performance. One caution here has to do with the mix of work from one period to the next. If the organization deals with a variety of outputs, and the mix of these outputs changes frequently, there may be a problem making comparisons from one performance period to the next. Organizations in this situation should insure that the outputs are expressed in equivalent units, or should measure over extended periods so that output mix balances out over time.

5. *Work Content*: Measure the effort that goes into a particular job or task. For example, a public works center may have a set of standards for how long a job should take. A measure of output can be the ratio of standard time for completed work to the actual time to accomplish the job. As this ratio improves, organizational performance is increased.

### **Process Improvement**

The imperative of every organization should be continuous improvement of the quality and efficiency of each process within that organization (see Nebeker, Wolosin & Tatum, 1996, for a

detailed model of organizational improvement). Process improvement begins with knowing your customers requirements, and then working backward from that point and making improvements to each process and subprocess that contributes to meeting these customer requirements. Many tools and techniques support for process improvement. Many of these improvement tools yield measures of how much the organization has improved over time. These measures are diagnostic in that they help the organization correct current problems and prevent future mishaps. A few of these tools and their corresponding measures are listed below.

1. *Data From Control Charts:* This approach to process improvement generates a statistical measure of the amount of variability or stability in an organization's processes over time. For example, one of the critical attributes of a technical document is the number of typographical errors. A control chart can show the average number of errors and the distribution of those errors over time. As an organization improves its document processing procedures, the control chart will reflect these improvements in a number of ways: (a) fewer "out-of-control" points (special causes of variation) will occur, (b) the overall variability in the distribution of errors will decrease, and (c) the average number of errors will decrease and move closer to the ideal zero point. For more information on the use of control charts see Deming (1986), Ishikawa (1985), Rumor and Brace (1991), Wheeler and Chambers (1992), or Gitlow, Gitlow, Oppenheim, and Oppenheim (1989).

2. *Benchmarking:* This technique systematically compares performance of a process to a similar process for another organization with an excellent reputation. As with control charts and other process measures, benchmarking is a good diagnostic tool (it shows the organization where the problems lie), but does not directly suggest exactly how the problem can be solved. The creative talent in the organization must devise changes that will improve the process. Once these changes are implemented, data from benchmarking tests can be used to determine if the changes led to improvements. Improvements are revealed by forming a ratio of the organization's performance to the performance of the benchmark. As this ratio grows larger, the organization is demonstrating improvement. Measures from this approach also yield information on the best practices available for making improvement.

3. *Time on Inspection:* The time spent inspecting the final product or service can be recorded. As the internal processes of the organization improve fewer and fewer labor hours should be devoted to inspecting the final output. This information can also be used to tell the organization how much cost could be eliminated by building quality up front.

4. *Time on Rework:* The time spent on rework can be recorded and compared to past years or to other organizations. Process improvements show up as decreases in labor hours spent on rework. The cost of rework can be combined with the cost of inspection to provide an indication of how much money could be saved if quality were built into the product or service from the beginning.

5. *Amount of Scrap and Waste:* The amount and costs of scrap and waste can be recorded. Process improvements are revealed by lower amounts of scrap and waste. This information can provide the organization with an idea of how much the yield could be increased from prevention or self-inspection.

## **Output Quality**

Besides measuring efficiency (the quality of the process), an organization needs to measure the quality of the end products and services. This measurement forms an important dimension of productivity measurement. Quality is the degree to which each unit of output possesses desirable characteristics (Nebeker et., 1983). Quality ultimately is based on the customers reaction to the product or service. If the customer is satisfied, then the product or service has desirable characteristics.

### **End-Product Inspection**

Although end-product inspection cannot create quality products and services, it can uncover and correct defects and prevent them from reaching the customer. Of course, in cases of financial transactions, safety-related work, and product liability, end-product inspections may be required (Deming, 1986; Ishikawa, 1985). The problem with end-product inspection as a quality control method is that, when defects are found, the only corrective actions available are reworking the product or consigning it to scrap. In either case, productivity suffers and costs rise. The yield is lower due to the extra labor involved in the rework and the cost of the material which has to be scrapped. In addition, products that have been adjusted or reworked are more likely to break down, which is exactly the opposite of quality assurance (Ishikawa, 1985).

Self-inspection by each worker in the process is preferred to end-product inspection. Self-inspection moves the quality assurance farther upstream and allows corrective and preventive actions to take place at an earlier, less costly, stage of the process. Self-inspection makes people more aware of problems and leads to earlier identification and corrective action. If an organization has not developed a mature system of self-inspection and prevention, and must rely on end-product inspection, there is really only one measure of output quality:

*1. Proportion of Output Units Passing Inspection:* This measure is obtained by counting the number of units that pass inspection and get into the hands of the customer. Improvements in the quality of the product or service are shown by increases in the proportion of outputs that pass inspection.

### **Product/Service Attributes**

Product/service attributes are those properties of the output that the consumer or end-user determines to be of value. Some of these are meeting customer desires (e.g., an end-user may desire certain extra features such as a MS Windows interface for a software application), uniformity (e.g., a sponsor may want research reports written in a standardize form), fitness for use (e.g., a customer may require travel orders to conform to a certain format so they can input the information into their computers), and reliability (e.g., a consumer may demand error-free data processing of its mailing list). The following list provides alternative measures of output quality that fall into the above categories. It is important to keep in mind that these are not mutually exclusive measures. Ideally, the organization should use as many of these as feasible so that quality is measured in a variety of ways.

1. *Customer Surveys:* Customers can be surveyed to ask about their level of satisfaction as well as current and future needs or desires. Possible survey items include: Rate the level of satisfaction for the following products/services. To what extent do our products or services meet your current needs? To what extent is our product or service delivered on time? To what extent is it delivered in the right amounts? Rate the reliability of product/service. To what extent are we helpful when you call us with a problems? An example of the use of survey data might come from a training command. The command can survey the trainees upon completion of the courses. These surveys can be followed by additional surveys of trainees and their supervisors several months later to see if the training continues to be useful. These data can then be used to assess whether the training command is making improvements in the course materials, instruction, and offerings.

2. *Statistical Process Control (SPC) Tools:* There are several tools used in SPC that provide valuable data on product and service attributes. For example, control charts can be used to show the uniformity of a product or service and whether the average value is close to the ideal (nominal) value of the output (see Gitlow et al., 1989, chapters 8-11). Similarly, the Taguchi Loss Function can also show output uniformity and conformance to the customer ideal (see Gitlow et al., 1989, chapter 15). Finally, process capability (see Gitlow et al., 1989, chapter 14) is a tool that can be used to show how well the output conforms to the specification limits. If the data from these SPC tools shows that, over time, the product or service is more uniform (less variable) and conforms to requirements, this is a good indication of improved quality. For example, a contracting organization records the time required to issue a contract and implements changes in the hope of improving contract deliveries. The above SPC tools can reveal reductions in the variability of issue time, as well as show how closely the issue time conforms to the time requirements of the customer.

3. *Structured Interviews:* Personal interviews (either direct or by phone) can be conducted with customers using the same questions you would pose in a survey. Interviews can provide information of greater depth than surveys because customer comments can be explored immediately. For example, external customers can be asked the extent to which the product or service is meeting their needs and preferences, and then dig deeper into problem areas revealed by the customers spontaneous comments. The results from these interviews can be quantified (see Dooley's, 1984. pp. 89-91, discussion of content analysis and paralinguistic process analysis for guidance) and an index of customer approval and problem identification can be developed. As the approval ratings increase, or as the problem areas decrease, product/service quality shows improvement.

4. *Customer Complaints:* An organization can measure how well it is satisfying its customers by the number and type of complaints that are registered. These data will reflect improvement over previous years if there is a decrease in the number and severity of complaints.

5. *Unsolicited Letters of Appreciation:* This is another way that the organization can measure how well it is doing in satisfying its customers. The data can then be compared to previous years to determine if the product or service is improving. The organization can also compare the data to the number and type of complaints in order to see the areas in which performance is good and the areas in need of improvement.

6. *Returns*: Failures of a product can be measured by the number of items that are returned for a refund or repair, and the data can be compared to data from previous time periods. When products fail, the mean-time-between-failure is a statistic that is commonly used to indicate improvement (decreases in mean-time-between-failure are indicative of improvement).

7. *Comment Cards*: Failures in service can be assessed by issuing customer response cards. For example, as with commercial hotels, a Bachelor Officer's Quarters can include customer feedback cards in the room that solicit comments on what was done well and what needs improvement. An index of overall improvement of service might be the ratio of positive to negative comments. As another example, an activity that makes travel arrangements can include a response card with every set of travel orders, and the ratio of positive to negative comments will reflect improvements in the service.

### **Timeliness**

Timeliness involves the time criticality of delivery (e.g., supplies are delivered when needed), the shelf life of inventory (e.g., pharmaceuticals are used before their effective date expires), and meeting milestones and deadlines (e.g., delivering a product on an agreed upon schedule).

1. *Just-in-Time Index*: In many organizations, the ideal is to have information or materials delivered to the customer "just-in-time." For example, an organization is delivering training to another organization, it is critical that the training be conducted at the time it is needed and not months too early or too late to be used effectively. A Just-in-Time index is a measure of how close in time the product or service is to the target time. The closer the actual delivery time is to the target time, the better the performance of the organization, and improvements are shown by ever-smaller differences in time.

2. *Shelf Life*: This is a measure of the life of a product before it is used. The shorter the shelf life of a product, the more frequently it must be reordered and restocked. Organizations for which shelf life is an important concern are hospitals (where the useful life of the drugs is a critical issue) and warehouses (where the shelf life of the supplies is of paramount concern).

3. *Conformance to Schedule*: Records can be kept on how well the organization is doing at delivering the right product or service at the right time in the right amount. As an example, a research and development organization may have deadlines for when summary reports are due to the sponsor. Good performance would be reflected by meeting the deadline or, under some circumstances, delivering ahead of schedule.

## **Financial Performance**

The second area in Table 1 shows financial performance. Financial performance refers to the profitability (in the private sector), budgeting (in the public sector), and market share of an organization. Effective organizations are able to compete successfully and acquire scarce resources for manufacturing their goods or providing their services. In turn, these resources are then transformed in a manner that is financially beneficial to the organization. This financial benefit is expressed as a ratio between the revenue generated and the costs to produce the product or service.

## Budgeting

Most organizations in the private sector are concerned with the maximization of profits as an objective. By contrast, most organizations in the public sector strive to stay within budget. Ideally, when an organization chooses among alternative business strategies, it should be able to forecast all future revenues and costs accurately and can achieve some degree of control over both. However, in the public sector improved budgeting normally means controlling and reducing costs relative to a mostly fixed source of revenue. Success is measured in terms of improving the ratio of revenue to cost. What follows are alternative ways of measuring the revenues and costs that form this ratio.

### Revenue

Organizations attempting to project their budget must consider the revenue generated from the product or service. Although some government organizations operate on a market-oriented, revenue generating basis (e.g., Defense Business Operating Fund), many others operate on appropriated funding in which the revenues are fixed by higher authority on a yearly basis. A data processing operation, for example, represents a somewhat market-oriented government enterprise. A data processing operation would look at (1) the cost to provide the services it offers, (2) what the customer might have to pay elsewhere, and (3) the "profit" margin it can reasonably expect. From these considerations, the data processing operation determines the rates to charge the customer which translates into potential revenue. A DOD headquarters operation, on the other hand, is a more traditional government institution. Headquarters usually receive appropriated funds from a Congressionally-approved budget. These funds are obligated on an annual basis and the headquarters must pay its salaries, purchase its materials, issue contracts, and support its field activities from these fixed dollar amounts. Regardless of whether the organization is market-oriented or traditionally funded, total revenue generated constitutes the primary financial measure.

*1. Total Revenue:* Measures the total dollars generated from the sale of all goods and services sold to customers, or from funds received from various funding agencies. In general, the more revenue generated the better the financial performance. Successful financial performance means acquiring sufficient revenue to cover operating costs and to allow a certain degree of future expansion.

### Costs

The number of input units purchased (e.g., labor, capital, materials, and energy) multiplied by the price paid for each unit yields the total cost of running an organization. The price of labor, capital, material, or energy depends on the supply and demand of the resources. The prudent organization seeks to purchase the highest quality units at the lowest possible price. The following list represents the major cost factors in a typical organization. This list bears a remarkable resemblance to the list of inputs quantities described under productivity. The present list represents the dollar equivalents of those input units.

*1. Dollars Spent on Total Labor:* A measure of the dollar costs to purchase the labor hours used to support the entire organization (both direct and indirect labor).

2. *Depreciation of Capital Assets:* The estimated cost of using property, plant, and equipment. For example, assume a machine is purchased for \$100,000 and then sold 8 years later for \$20,000. The cost of using this fixed asset is \$80,000 over its 8-year useful life. In any given period, the cost is a prorated share of the \$80,000.

3. *Dollars Spent on Materials:* The dollar cost of the materials purchased by categories (e. g., supplies, minor equipment).

4. *Dollars Spent on Energy Consumed:* A measure of the dollar cost of purchasing the energy used in the manufacturing of goods or the delivery of services.

Once the revenues and costs are measured, the financial success can be assessed by examining the ratio of revenue to cost. As the ratio increases, the financial performance of the organization improves. It is important to note, however, that financial performance is not necessarily the same as productivity. A high revenue/cost ratio does not necessarily imply that the organization is more productive because this ratio can be influenced by factors that are independent of the output/input productivity ratio (e.g., price increases because of higher demand or lower supply can increase the revenue more than it increases costs). Likewise, a lower revenue/cost ratio does not necessarily imply that the organization is less productive for much the same reason (e.g., if the customer negotiated a lower price for a product, or competition drove the price down, this would lower revenue without necessarily reflecting a productivity decline).

## **Marketing**

Effective organizations perform market analyses to understand their markets for their products or services. Market analyses provide information such as who the consumers are, where they are located, why they purchase the product or service, where they purchase the product or service, what percentage of the market does the product attract, who the competition is, and what the trends in product changes are?

Once an organization has determined its current market share, it can set goals for increasing its share and explore methods for doing this. Ordinarily, we don't think of a public sector organization being concerned with market share, competition, or the generation of revenue. However, political trends are encouraging the public sector to behave more like the private sector. Marketing is especially critical for organizations pursuing PGS because new markets represent new opportunities to expand and improve. A useful measure related to marketing is:

1. *Market Share:* The amount of products and services provided by the organization as a percentage of the total products and services available in the market. For example, a research and development organization can assess what percent of the government research dollars in their specialty area they currently attract. If they can develop strategies for increasing their market share, they can enhance their reputation, attract more highly qualified researchers, and perform higher quality research. Percent of market share thus becomes a measure of success, with improvement indexed by a higher market share.



## Stakeholder Relations

The third major area identified in Table 1 is stakeholder relations. Stakeholders are groups and individuals inside and outside the organization who affect and are affected by the organization. Stakeholder relations refers to the effectiveness of an organization in satisfying its stakeholders and insuring the organization's long-term survival. The payoff for improving stakeholder relations is not immediate; rather improving stakeholder relations helps to secure a future for the organization. Stakeholder relations can be subdivided into four general areas: employee quality of work life (QWL), customer relations, public relations, and government relations.

### Employee Quality of Work Life

QWL addresses how the relationship between individuals and features of their physical, social, and economic work environment affects on-and-off-the-job attitudes and behaviors (Wood, Rasmussen, & Lawler, 1975, p. 23). Employee QWL can be measured in different ways for different attributes. Some measures of employee QWL are:

1. *Organizational Climate Survey*: Such a survey assesses different areas of QWL. Typically, a climate survey contains sections that cover job satisfaction, stress, motivation, commitment, and organizational culture. Each of these sections can usually be administered separately or together to obtain a general picture of these facets of QWL. The Navy Personnel Research and Development Center has available a climate survey that will reliably and accurately measure this characteristic of an organization. If a climate survey is administered on a regular basis, improvements in these areas can be shown across time.

2. *Data From the Dispensary*: The Dispensary should have records on the illnesses, accidents, and injuries that have been filed. These can be measured by looking at incidence, frequency, and severity rates. These can then be categorized into insured and uninsured illnesses, accidents, and injuries. For more information, see Novit (1979, pp. 207-209). Data from each of these categories can then be compared against past organizational records and/or to other comparable organizations to determine if improvements are being made.

3. *Absenteeism and Turnover*: The personnel office should have records of employee absenteeism and turnover. By collecting and analyzing this information periodically, an organization can see improvements that occur over time (i.e., if the frequency of absenteeism and turnover diminishes over time, this shows improvement).

4. *Exit Interviews*: Information obtained from the exit interviews can be classified according to reasons for leaving. These categories can be tracked over time. If the frequency of certain categories decreases over time (e.g., employees left because of poor advancement potential or because of bad working conditions) then this reveals improvement in the area of turnover.

### Customer Relations

Customer relations refers to the relationships an organization has with its internal and external customers. Internal customers are members within the organization that depend on one another in the manufacturing of a product or the delivery of a service. External customers are people who buy

or use the organization's product or service. Effective organizations listen to their customers wants, are customer oriented, and satisfy the requirements of the customer without ignoring price, profit, quality, and cost control (Ishikawa, 1985).

Both internal and external customers have needs and preferences that must be satisfied. Satisfaction levels of internal customers can be assessed by a survey. Satisfaction of external customers was discussed earlier in the context of output quality, and referred to the continual usage of, purchase of, and confidence in a product or service by the users. In the context of customer relations, the interest is in the customer's perceptions of the organization as a whole (its reputation) and not just the quality of its products and services. Measures of customer relations include:

1. *Internal Customer Survey*: Every organization is composed of numerous internal supplier/customer relationships (e.g., engineering is a supplier to manufacturing, manufacturing is a customer of engineering but a supplier to sales). A survey can measure the degree of satisfaction for these internal relationships and, if these measures are followed over time, the organization can tell if improvements are occurring.

2. *Organizational Reputation Surveys*: The external customers of the organization can be surveyed to determine their perceptions of the organization. Questions on the survey can address issues related to the organization's general reputation and status in the community. If the survey is administered, on several different occasions, trends can be noted and the data will indicate if the organizations reputation is improving over time.

3. *Focus Group Interviews*: A common technique used in marketing involves conducting interviews with focus groups. Focus groups are small groups of people who have an interest in the organization or its products and services (e.g., employees, customers). These focus groups are interviewed together to get an in-depth analysis of the organization (e.g., what is good or bad about the organization, what areas need improvement, what problems are occurring?). Generally, the results from these interviews are of a qualitative nature (e.g., verbatim comments from members of the focus group), but these qualitative data can be quantified using content analyses or paralinguistic process analysis (Dooley, 1984, pp. 89-91). For example, a content analysis can show the extent to which customers use positive words and phrases to describe the organization. If focus group interviews are conducted periodically, content analysis might show a trend toward more positive descriptions. Such a trend would be indicative of increased positive perceptions from the customers and an improved reputation.

4. *Unsolicited Letters*: Many organizations (especially those involved in delivering services) receive unsolicited letters of either condemnation or commendation. These comments can be classified (e.g., as positive or negative) and the changes can be viewed across time. An increase in positive letters or a decrease in negative letters are indications of improved customer relations.

## **Public Relations**

Organizations must be concerned with their image and reputation in the eyes of all their stakeholders (e.g., sponsors, citizens, taxpayers, shareholders, owners). Private organizations are especially concerned with how they are perceived by their shareholders and owners. Public organizations are more concerned with the perceptions of legislators, sponsors, citizens, and

taxpayers (who are, in a sense, like voting shareholders in a corporation). The U. S. Postal Service, the Social Security Administration, the Internal Revenue Service, and the DOD, for example, must be concerned with the image they project to public officials and the general public. In addition, government organizations must cultivate positive relations with their claimants and sponsors because funding (and sometimes their survival) depends on these outside organizations. Without a good image and a sound reputation, long term survival is in jeopardy. A positive image aids survival by attracting and maintaining funding, keeping current customers content, and building a base of support from the taxpayers. An organization's image can be influenced by at least four things: (1) the outcomes of its efforts; (2) the way it conducts business; (3) the effect it has on the environment, and (4) how well it serves the community. Measuring and improving public relations can be accomplished in several ways:

1. *Public Opinion Survey*: Various stakeholder groups can be surveyed to determine if they have positive or negative attitudes about the organization. Questions might include: How positive do you perceive us in comparison to other similar organizations? Do you perceive our organization as one that can be trusted to provide quality products? Do you view our business actions in a positive manner? Do you feel that our organization affects the environment in a negative manner? Do you feel that our organization is an asset to the community? This information can be used to address deficiencies in your public image and to fortify the things you are doing well. Improvements will be revealed by higher ratings of your organization by the various groups.

2. *Unsolicited Letters of Approval or Disapproval*: The organization can measure how positive its public image is by the number of unsolicited letters of approval or disapproval. The content of these letters can be classified as positive or negative and followed over time. Improved public relations is revealed by an increase in positive letters and a decrease in negative letters.

## **Government Relations**

All organizations must comply with government regulations. Specific agencies ensure that organizations complying with regulations regarding their type of business. For instance, the Equal Employment Opportunity Commission has regulations that govern the hiring and firing of employees. If organizations fail to comply with these regulations, the government has the legal authority to administer penalties, fines, and even to close them down. Some alternative ways of measuring effective government relations include:

1. *Inspection Team Reports*: Many organizations undergo periodic inspections to insure that they are complying with local, state, or federal regulations. An organization can compare how well it was assessed by the inspection team (e.g., number of discrepancies weighted by the seriousness of each) to previous years. In this way, they can measure how much they have improved.

2. *Complaints Regarding Regulatory Violations*: The organization can measure how well it is doing in different areas by how many grievances or complaints (by employees, unions, regulatory agencies) have been filed during a specific time. These complaints can then be compared to previous years. This will give an indication of how well the organization is complying with various regulations (e.g., equal employment, fraud, waste, abuse).

3. *Meeting Codes/Regulations:* Organizations can document their compliance with various codes and/or regulations. For example, they can document all compliance with fire code specifications. They can also document whether they have been fined or penalized. If compliance tends to go up over time, and fines and penalties go down, this serves as an indication of improvement in these areas. These improvements are also important because noncompliance with codes and regulations can be costly.

## **Resource Development**

The fourth area in Table 1 is resource development. Measures of resource development are important to an organizations effectiveness because, before an organization can be efficient, it must develop the quality of its resources. In addition to increasing efficiency, developing quality resources creates more opportunities to improve the quality of products and services. Resource development can be subdivided into two general areas: employee development and technology development. Each of these areas can, in turn, be broken down into smaller areas. For each of these subareas, several alternative measures will be suggested.

### **Employee Development**

Most organizations feel that the employees are their most valuable resource. Certainly, any organization that wants to deliver quality goods and services needs a highly skilled and dedicated work force. How can an organization tell if it is adequately developing its human talent? It must measure important areas of employee development and then make efforts to improve in these areas. Employee development consists of three major areas: (1) recruitment, (2) selection, and (3) training. We will provide a brief review of these areas and then suggest ways of determining whether an organization is doing a good job in developing its employees.

#### **Recruitment**

Employee development requires that an organization have some notion of its manpower needs and the size of the labor market. Knowing manpower needs and predicting labor supply is crucial to: (1) succession planning, (2) strategic planning, (3) reductions in work force, (4) budgeting, and (5) formulating training and recruitment strategies. The success of recruitment is measured in terms of the recruitment ratio. The recruitment ratio is the ratio of the number of persons recruited to the number of qualified candidates. Generally, an organization wants a high selection ratio (i.e., a large number of qualified candidates for a given number of recruits) because this reflects an efficient use of resources. An organization can use one or more of the following sources to obtain data for computing a recruitment ratio.

1. *Data From Personnel Office:* The personnel office should have records on who was considered for each position and who met the minimum qualifications. A ratio can be computed from these data that reflects the proportion of job applicants to qualified candidates. Sorting through the applications of unqualified, or marginally qualified, candidates wastes time and energy. If computing the ratio over time yields an upward trend, then the recruitment process is likely to improve (i.e., the organization is recruiting more qualified candidates).

2. *Data From Bureau of Labor Statistics and Census Bureau:* This information can tell the organization the condition of the national and regional labor market for various labor categories. The organization can then compare labor categories within the organization to these national and regional demographics to determine whether their recruitment policies are better or worse than national and regional trends (for an example of how such data was used in the U.S. Navy, see Atwater & Niehaus, 1993).

3. *Data From Local Information Sources:* Information on the local labor supply can be gleaned from the Chamber of Commerce, local newspapers, or employment agencies. This information can be useful in assessing recruitment efforts by comparing the labor situation within the organization (e.g., EEO complaints, union grievances, level of diversity) with the situation in the local community. Again, trends across time show the organization whether improvements are being made or whether corrective action is needed.

### **Selection**

Selection refers to hiring the right person for the job. Better selection will improve an organization's performance between: (1) employees who have the right abilities perform more effectively, (2) good selection procedures lower costs (e.g., if people are retained longer, the cost of recruitment and new-employee training goes down), (3) good selection avoids many legal problems resulting from unfair hiring procedures (Dessler, 1988, pp. 167-168).

Improving the selection process is complicated and requires information on the (1) cost of the selection tests, (2) validity and reliability of the tests, (3) costs of recruiting and training, (4) selection ratio (the proportion of the candidates that are selected), and (5) estimates of the employees' dollar contribution to the organization. With this information, there are several techniques for conducting what is known as "utility analysis" (e.g., Cascio & Ramos, 1986; Schmidt, Hunter, McKenzie, & Muldrow, 1979). A utility analysis of an organization's selection procedures will show, in dollars, the effectiveness of the current procedures. A utility analysis can also be used as a metric to measure the degree of improvement resulting from changes in the selection procedures. For example, if the organization adopts a new, more expensive selection test with a higher validity, a utility analysis can show whether the new test is cost effective. The information needed for utility analysis will come from several sources.

1. *Data From Personnel Office:* The personnel office should have records on who was considered for each job position and who was hired. A selection ratio can be computed that reflects the proportion of job candidates to job hires. The personnel department should also have information on the different selection tests employed and their costs, reliabilities, and validities. Finally, data on the costs of recruiting and training new employees should be available through the personnel office.

2. *Survey of Budget Analysts:* Budget analysts, or others with expertise in the financial performance of the organization, must be surveyed to obtain data on the differences between the value of the products and services produced by different employees.

## **Training**

How can an organization tell if its training program is effective? In order to have coordinated, methodical, cohesive, and accountable training programs that share symmetry with the organization's objectives, a needs assessment and evaluation of training effectiveness must be done. To know if the training is effective, the organization must have some idea of its critical needs. Once its needs are known, the organization can then design a training program to meet those needs. Effective training programs increase the knowledge, skills, and abilities of employees in those areas of critical need. If an organization is using its resources wisely, then it should be able to show improvements in training effectiveness over time. The effectiveness of the training program can be assessed in a number of ways.

1. *Acquisition Measures:* The effectiveness of training in the acquisition of knowledge, skills, and abilities can be measured by giving the trainee a test before and after training. The difference in the before-and-after test scores will yield information regarding newly acquired knowledge and skills. Such tests can be created in-house, or if an outside organization conducts the training, an external agency may provide the test results. The organization should continuously collect this information and see if the acquisition of skills and knowledge improves over time. Improvements in these acquisition measures would reflect improvements in training efforts.

2. *Job Performance Measures:* Effective training involves not only acquisition of new knowledge, skills, and abilities, but also the changes in actual job performance. Measures of job performance can be assessed before and after the training. If the employee can improve job performance over time, it is an indication that the training is effective.

3. *Standardized Tests:* A measure of the quality of your training can be obtained by administering standardized tests that assess the knowledge, skills, and abilities that you desire in your work force. These tests are available through a large number of commercial publishers, but are usually expensive and should be administered by a qualified examiner. However, should you choose to go this route, you can track improvements over time and assess the effectiveness of your training.

## **Technology Development**

Technology development refers to the use of resources for development of new technology in the workplace. It consists of the physical and informational resources by which people bring about some desired result (e.g. manufacturing a product or delivering a service). Technology development concerns the methods, processes, and physical resources an organization uses in the course of business.

## **Work Methods**

Organizations should have a thorough understanding of the methods and processes that are used to create their products or deliver their services. First, an organization should identify the types of work methods that must be performed. Second, the organization should select the specific work methods best suited to its operation. Finally, the organization should assess the effectiveness

of its work methods. Work methods that are ineffective should either be improved or replaced. Several possible measures of work methods are:

1. *Time Since Last Process Analysis:* Process analyses determine the best work methods for a particular operation. If it has been a long time since such a study has been performed, this could be an indication that the most up-to-date methods are not being employed. An organization should keep track of the frequency with which such methods and analysis studies are conducted, and compare the data to past performance periods. If the time lag between studies grows too large relative to other periods, this may be an indication that the work methods are not being managed well.

2. *Benchmarking:* This technique allows the organizations to compare the effectiveness of its work methods to the effectiveness of methods used at similar organizations that are considered to be the "best" organizations. An organization can form a ratio of the performance of their methods to the performance of the methods used by other organizations. When this ratio is observed over time, the organization can see whether their methods are improving, and if not, what new work methods might be appropriate.

3. *Use of Latest Technology:* If an organization is familiar with the latest technology, it can record what percentage of its current work methods conform to this technology. For example, a software developer can record the use of current programming tools, and determine the percentage of these tools that conform to the most recent technical tools available (e.g., CASE tools, object oriented programming). As the percentage increases, the organization can infer that it is improving work methods.

### **Physical Resources**

The physical resources of an organization are its facilities and tools and equipment. How does an organization know if it has the proper physical resources for its operation? There are several aspects that an organization should be concerned with.

1. *Age of Physical Resources:* Organizations usually keep records on the purchase dates of tools, equipment, and facilities. These records tell how old these resources are. As the tools, equipment, and facilities age, the resources become less useful and eventually require replacement. The age relative to useful life can be used as an index of how effective the resources are being used. If the average age of the resources decreases over time, this tells the organization that it is keeping the tools, equipment, and facilities up to date.

2. *Condition of Physical Resources:* Most organizations keep maintenance records on their tools, equipment, and facilities. These records can be used to show the physical condition and operational state of the resources. From these records, an index can be developed that can be compared from one time period to the next. If the index improves over time, the organization shows improvement in the use of its physical resources.

The success of PGS rests on the quality of the measurement system. The measurement system must, of course, accurately reflect improvements in productivity.

## Conclusions

Measures of productivity are only part of the picture of productivity gain sharing. PGS is a systems approach to organizations, and therefore the emphasis should be on total organizational improvement and not just improvement in one area. This report has been a primer and a brief introduction to organizational effectiveness. We have shown that effectiveness can be divided into four distinct areas (productivity, financial performance, stakeholder relations, and resource development), and we have given many examples of how each of these areas can be measured. Although the examples come primarily from white collar organizations, most of the measures discussed apply to all types of organizations. The important point is that an effective PGS plan should incorporate some measures from all four areas so that total organizational performance can be monitored and improved. Effective organizations realize that there must be a balance between these areas. If one aspect of the organization is performing optimally (e.g., human resources are being effectively utilized), but another area is performing poorly (e.g., the budget can not be adhered to), then the overall ability of the organization to perform will be compromised.

Reviewing the measures set forth in this report provides the organization with some tools for assessing where its strengths and weaknesses lie. Reviewing these measures should cause an organization to think about areas not previously attended to that are important to achieving the organization's goals. We do not wish to convey the idea that every organization should adopt all of these proposed measures, nor do we believe that this document contains an exhaustive list of performance measures. Each organization should decide which measures are most relevant to its goals and needs, and customize and develop its own measures if these do not suit its purposes. If an organization does develop its own performance measures, we hope that the examples presented here serve as a useful guide. At the very least, an organization should select or develop measures from each of the four major areas (productivity, financial performance, stakeholder relations, and resource development).

Of course, selecting the relevant set of measures is just the beginning as far as PGS is concerned. These measures must also be monitored over time, revised, adjusted, and replaced. The set of measures must, at some point, be combined to form a unified picture of total organizational performance. This combining of performance measures is discussed at some length by Nebeker and Tatum (1996) and Tatum, Nebeker, and De Young (1996) who demonstrate alternative approaches to aggregating performance measures. Finally, these measures must be translated into dollar values so that appropriate financial payouts can be made based on the value of the measured improvements in the organization (see the two Nebeker and Tatum articles for suggestions on how this translation can be accomplished).



## References

- Atwater, D. M. & Niehaus, R. J. (1993, June). *A human resource forecast for the year 2000: Transition to employee value*. Paper presented at the Human Resource Planning Society Research Symposium, Ithaca, NY.
- Bureau of Labor Statistics (1993a). *Developing output indicators for federal productivity measurement*. Washington, DC: U. S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology.
- Bureau of Labor Statistics (1993b). *Description of output indicators by function for the federal government, fiscal year 1991*. Washington, DC: U. S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology.
- Bureau of Labor Statistics (1993c). *Labor productivity trends for federal government functions and the measured total* (Part III of the BLS bulletin titled "Productivity Measures for Selected Industries and Government Service"). Washington, DC: U. S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology.
- Bureau of Labor Statistics (1993d). *Productivity statistics for federal government functions*. Washington, DC: U. S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology.
- Cascio, W. F., & Ramos, R. A. (1986). Development and application of a new method for assessing job performance in behavioral economic terms. *Journal of Applied Psychology*, 71, 20-28.
- Deming, W. E. (1986). *Out of the Crisis*. Cambridge, MA: Massachusetts Institute of Technology.
- Department of Defense. (1992). Memorandum for Under Secretary of Defense for Acquisition of 29 Oct 92, Subj: Performance Budgeting, by Donald Shycoff. Washington, DC.
- Dessler, G. (1988). *Personnel management* (4th ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Dooley, D. (1984). *Social research methods*. Englewood Cliffs, NJ: Prentice-Hall.
- Forte, D. (1993). Measuring federal government productivity. In W. F. Christopher & C. G. Thor (Eds.), *Handbook for productivity measurement and improvement* (pp 7-3.1-7-3.16). Washington, DC: Productivity Press.
- Gitlow, H., Gitlow, S., Oppenheim, A., & Oppenheim, R. (1989). *Tools and methods for the improvement of quality*. Homewood, IL: Richard D. Irwin, Inc.
- Ishikawa, K. (1985). *What is total quality control? The Japanese way* (D. J. Lu, Trans.). Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Nebeker, D. M., Neuberger, B. M., & Hulton, V. N. (1983). *Productivity improvement in a purchasing division: Evaluation of a performance contingent reward system (PCRS)*. (NPRDC-TR-83-34). San Diego, CA: Navy Personnel Research and Development Center.

- \*Nebeker, D. M., & Tatum, B. C. (1996). *An Approach to measuring quality and productivity for gain sharing: Measuring total organizational value* (NPRDC-TN-96-33). San Diego, CA: Navy Personnel Research and Development Center.
- \*Nebeker, D. M., Tatum, B. C., & Wolosin, D. G. (1996). *A typology of organizational effectiveness* (NPRDC-TN-96-28). San Diego, CA: Navy Personnel Research and Development Center.
- Nebeker, D. M., Wolosin, D. G., and Tatum, B. C. (1996). *A model of continuous organizational improvement: Integrating gain sharing and total quality* (NPRDC-TN-96-27). San Diego, CA: Navy Personnel Research and Development Center.
- Novit, M. S. (1979). *Essentials of personnel management*. Englewood Cliffs, NJ: Prentice-Hall.
- Rich, P. (1993). The organizational taxonomy: Definition and design. *Academy of Management Review*, 17, 758-781.
- Ringham, A. J. (1982, October). *Designing a gain sharing program to fit your operations*. Paper presented at the Gain sharing Conference sponsored by the Institute of Industrial Engineers. Washington, DC
- Rumor, G. A., & Brace, A. P. (1991, January). Managing the white space. *Training*, 55-70.
- Schmidt, F. L., Hunter, J. E., McKenzie, R. C., & Muldrow, T. W. (1979). Impact of valid selection procedures on work-force productivity. *Journal of Applied Psychology*, 64, 609-626.
- \*Tatum, B. C., Nebeker, D. M., & De Young, P. H. (1996). *Using performance indexing to measure organizational gains in white collar environments* (NPRDC-TN-96-27). San Diego, CA: Navy Personnel Research and Development Center.
- \*Tatum, B. C., Shaw, K. N., and Main, R. E. (1996). *Integrating measurement approaches in gain sharing and total quality* (NPRDC-TN-96-31). San Diego, CA: Navy Personnel Research and Development Center.
- Tuttle, T. C. & Sink, D. S. (1984). *Taking the threat out of productivity measurement*. *National Productivity Review*, 3(1), 24-32.
- Tuttle, T. C., Wilkinson, & Mathews, R. E. (1985, August). *Field test of the methodology for generating efficiency and effectiveness measures* (AFHRL-TP-84-54). Brooks AFB, TX: Manpower and Personnel Division, Air Force Human Resources Laboratory.
- Wheeler, D. S., & Chambers, D. S. (1992). *Understanding statistical process control* (2nd ed.). Knoxville, TN: SPC Press.
- Wood, M., Rasmussen, J. E., & Lawler, E. E. (1975). *Federally sponsored research on the quality of working life: Planning, support, and products*, 23. Seattle, WA: Battelle Memorial Institute, Human Affairs Research Centers.

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